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✓ Peach Precooling Tests 1951 X

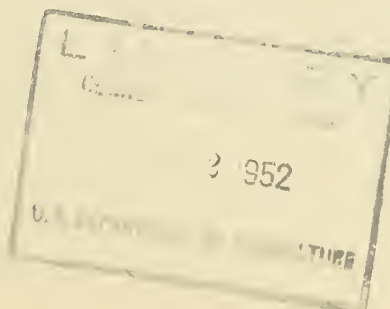
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PEACH PRECOOLING TESTS - 1951

Shipping tests from South Carolina to New York in 1948 (A.A.R. - U.S.D.A Test No. 29) indicated that the rate of cooling in cars of peaches packed naked in ventilated bushel baskets that were loaded only 3 baskets high in standard refrigerated cars was rather rapid and no appreciable benefit was obtained by precooling with the bunker ice and the built-in (Preco) fans. Since the lack of benefit from precooling was contrary to results that have been obtained with wrapped peaches in boxes (H. T. & S. No. 175) and with other commodities it seemed desirable to repeat that experiment to see whether the results could be confirmed.

1951 Test Shipments

In cooperation with the American Fruit Growers two tests along these lines were arranged at Fort Valley, Georgia. In each test 2 fan cars were used. In the first test the comparison was between precooling by means of the bunker ice and Preco fans operated by electric motors and precooling by means of a portable compressor on a truck (General American Precooling Co.). The second test was a comparison between a short precooling by means of the portable compressor and a non-precooled car. The test treatments are outlined in table 1.

Table 1.--Precooling treatments

Test	Date	Car No.	Loading		Kind	Precooling		
			Start	End		Start	End	Time Hr.
1	6/15/51	WFE 68082	11:30A	2:00P	Preco	2:30P	7:30P	5
		WFE 66631	10:00A	11:30A	Portable compressor	1:50P	6:50P	5
2	6/26/51	FGE 39440	4:30P	7:40P	None			
		WFE 72287	1:20P	4:30P	Portable compressor	5:00P	7:50P	2 5/6

All cars were loaded with the peaches packed naked in half bushel ventilated baskets and loaded in the cars 4 baskets high with 832 baskets per car. The cars were pre-iced and rolled with the fans on under standard refrigeration with 3 per cent salt added at the first icing station on the basis of the bunker capacity and at the second icing station on the basis of the amount of ice supplied. The test cars were routed Southern, Central of Georgia, Southern and Pennsylvania Railroads.

Temperature Records

Temperature records were obtained by means of Ryan recording thermometers. Air temperatures were obtained at the ceiling near the bunker and under the floor racks near the fans. Commodity temperatures were recorded by thermometers placed in the center of baskets of peaches loaded in the first, second and top layers near the centerline, quarterlength position. Outside temperatures enroute were obtained by attaching a Ryan thermometer to the underside of one of the cars of

each test. Previous to their use the recording thermometers were tested at room temperature in comparison with an accurate mercury thermometer to determine their error at high temperatures. They were also checked after arrival at the market by placing them in a refrigerator at 45° F. to determine their error at low temperatures. The correction factors for operation at high and low temperatures did not always agree in which case a variable correction was applied to the readings.

Test Packages

Six half bushel lots of peaches loaded at the top doorway position in each car served as test packages. The peaches in two of the baskets were sprayed with a suspension of spores of the brown-rot organism. In two other baskets the peaches were punctured with nine shallow-pin pricks and sprayed with a suspension of Rhizopus spores and the fruit in the other two baskets was not inoculated. The fruit for the test packages was picked the day before the shipping test but was not inoculated until the morning of the test at which time it was sorted over and ripe or decayed peaches were discarded.

Test No. 1

The bunkers of car WFE 68082 (Car A) that was precooled by circulating air through the bunker ice by means of Preco fans operated by electric motors were about 2/3 full of ice in rather large blocks when loading was completed. Before starting to precool the larger blocks were broken up slightly and about 200 pounds of salt was added to each bunker. This salt was equivalent to over 5 percent of the weight of ice remaining. In accordance with commercial practice at this shed, ice was not replenished before precooling. At the end of precooling the bunkers were still 1/4 to 1/3 full.

Car WFE 66631 (Car B) was precooled by means of a portable compressor furnished by the General American Precooling Co., which the operator stated had a rated capacity of 30 tons per day. On the basis of this rated capacity during the 5 hour precooling period it theoretically had a cooling capacity equivalent to 6 1/4 tons (12,500 pounds) of melting ice. In addition there would have been some cooling of the load by the bunker ice during loading as the bunker ice had melted down 1 to 1 1/2 feet below the hatch openings representing a meltage of 1,000 to 1,500 pounds of ice. Theoretically, therefore, car B should have cooled 3 to 4 times as much as car A in which only 3,000 to 4,000 pounds of ice was estimated to have melted. Actually the results show little or no difference in the amount of cooling of the two cars indicating that cooling capacity of the compressor unit was much less than its rated capacity would indicate.

The temperature records for these 2 cars taken from the thermometer charts are shown in table 2. In both methods of precooling the cooled air was blown out over the top of the load so that the ceiling air temperature represents the temperature of the cooling medium. These ceiling air temperatures indicate precooling was somewhat more effective with the bunker ice than with the compressor unit at the beginning of precooling period when the bunkers were fairly well filled

with ice but became less effective later in the precooling period when the bunker ice was nearly depleted. At the end of the 5 hour precooling period the commodity temperatures averaged about 4 degrees lower in car B cooled with the portable unit. However, 3 hours after precooling was finished there was no difference in the commodity temperatures in the 2 cars.

The condition of the fruit in the test packages on arrival and after 2 and 4 days at room temperature is shown in table 3. Since there was practically no difference in commodity temperature in the two cars, no appreciable difference in the condition of the fruit would be expected and none was found. The average loss in weight of the fruit was 1.7 percent for each car. Eleven and 7 percent of the fruit was eating ripe on arrival. After 2 days at room temperature 31 to 65 percent of the peaches in the various lots were considered to be ripe. By 4 days after arrival all of the fruit that had not decayed was classed as ripe. Total decay on arrival averaged less than 1.0 percent in both cars. Even after 4 days at room temperature the total decay ranged from 1.6 to only 7.1 percent as the maximum in any of the uninoculated lots. Artificial inoculation greatly increased brown rot and Rhizopus rot but there was no significant difference between the cars.

Summary Test 1

Precooling with the bunker ice by means of the Preco fans was not done under optimum conditions as the ice was in larger blocks than desirable and appreciable ice meltage had occurred before precooling started and the ice was not replenished. Even so precooling for a period of 5 hours with bunker ice and fans was practically as effective as precooling with a portable compressor rated at 30 tons. Had precooling extended over a longer period additional cooling could have been accomplished by the portable compressor whereas very little additional cooling could have been obtained from the other method unless the ice was replenished. Precooling with the portable compressor was not as rapid as might be expected from its rated capacity.

Test No. 2

This test was intended to be a repetition of test no. 1, but due to delays in loading there was no time to precool car C (FGE 39440) and slightly less than 3 hours was available for precooling car D (WFE 72287) with a portable precooler before both cars were pulled out. Consequently the non-precooled car had the benefit of fan operation (in transit) almost immediately after loading was completed.

Temperature records for these 2 cars taken from the thermometer charts are shown in table 4. They indicate that cooling was as fast in the non-precooled car that was pulled out immediately after loading as in the car that was precooled for only 3 hours. During the latter part of the transit period the average commodity temperatures were appreciably lower in the non-precooled car than in the precooled

car. A possible explanation for this was that one of the fans on car D was found to be out of order and not operating on arrival at the terminal market. The fairly large difference in temperature between the top and bottom of the load in this car during most of the transit period would indicate that the fan may have been out of order during most of the transit period.

The condition of the fruit in the test packages is shown in table 5. There was no appreciable difference in weight loss in transit. The percentage of ripe fruit averaged slightly higher in the precooled car than in the non-precooled cars but this slight difference also was not significant. Because of the high percentage of decay that developed even on uninoculated fruit only a relatively small percentage of the fruit ripened without decay. Precooling apparently reduced decay from natural infection (uninoculated samples) but had no effect on decay from inoculations just previous to loading.

Summary

The results indicate that a short period of precooling (up to 5 hours) with a portable compressor refrigerating unit was not appreciably more effective than precooling by forced circulation of the air through the bunker ice. They tend to support the results of earlier tests in indicating that cooling of loads of peaches packed naked in ventilated baskets is rather rapid in fan cars when moved promptly after loading and shipped under standard refrigeration plus salt at reicing. Under these conditions little benefit to the condition of the fruit or development of decay was indicated from a short period of precooling.

Table 2.--Temperature records during precooling and enroute from Fort Valley, Georgia to New York City, Test No. 1, 1951

Car A (WFE 68082) - Precooled with bunker ice and Preco fans

Position <u>1/</u>	Reading	Temperature (°F.) at indicated hours after start of precooling <u>2/</u>										
		0-	0+	5	12	24	36	48	60	72	84	96
Top Bunker	Air	72	54	50	59	42	40	50	40	54	47	54
Bottom Bunker	Air	47	63	58	43	44	41	41	40	39	37	36
TQL	Com.	78	77	61	61	54	46	42	43	42	43	44
MQL	Com.	78	76	63	62	55	47	43	41	40	39	40
BQL	Com.	71	70	62	58	50	45	42	40	40	40	40
Average	Com.	76	74	62	60	53	46	42	41	41	41	41

Car B (WFE 66631) - Precooled with portable compressor

Top Bunker	Air	75	62	45	49	54	40	37	47	46	46	47
Bottom Bunker	Air	44	46	40	46	36	43	41	40	40	37	37
TQL	Com.	79	78	61	57	51	46	43	42	41	42	43
MQL	Com.	77	75	55	54	51	47	42	42	40	41	42
BQL	Com.	80	76	59	55	49	46	43	42	42	42	42
Average	Com.	79	76	58	55	50	46	43	42	41	42	42
Outside	Air	76	76	74	67	80	64	85	62	73	61	79

1/ Positions TQL, MQL, and BQL represent top, middle and bottom quarterlength, respectively.

2/ The temperature just before precooling started is represented as the 0- reading and those immediately after precooling started by 0+.

Table 3.--Condition of Dixigem peaches in test packages on arrival at terminal market and after 2 and 4 days at room temperature.
(Test 1 - 1951)

Lot No.	Inoculation treatment	Net Wt. Georgia Lbs.	Wt. loss in transit %	Eating ripe at each inspection (Cumulative Percent)			Decay at each inspection (Cumulative Percent)			At Arrival			After Two Days			After Four Days			
				Total fruit No.	At Arrival 2 days %	After 4 days %	B 1/ R 1/ O 1/ %	Total %	B %	R %	O %	Total %	B %	R %	O %	Total %	B %	R %	O %
WFE 68082 - Precooled with ice and Preco fans																			
A-1	Check	27.0	1.1	170	13.5	54.7	97.1	0	0.6	0	0.6	1.8	0.6	0	2.4	2.3	0.6	0	2.9
A-2	Check	28.5	1.4	184	11.4	62.5	98.4	0.5	0.5	0	1.0	0.5	0.5	0	1.0	0.5	0.5	0.6	1.6
	Sub-total and average	55.5	1.3	354	12.2	58.8	97.7	0.3	0.5	0	0.8	1.1	0.6	0	1.7	1.4	0.6	0.3	2.3
A-3	Inoc. B. R.	27.5	1.5	177	4.0	31.1	65.0	0	0.6	0	0.6	3.4	6.8	0	10.2	15.2	19.8	0	35.0
A-4	Inoc. B. R.	26.5	2.3	162	12.3	35.8	53.7	0	1.2	0	1.2	8.0	11.1	0	19.1	32.0	14.3	0	46.3
	Sub-total and average	54.0	1.9	339	8.0	33.3	59.6	0	0.9	0	0.9	5.7	8.8	0	14.5	23.3	17.1	0	40.4
A-5	Inoc. Rhiz.	27.2	1.8	165	10.3	41.8	54.5	0	0	0	0	0.6	20.6	1.2	22.4	0.7	43.6	1.2	45.5
A-6	Inoc. Rhiz.	27.7	2.2	163	14.7	49.7	74.2	0	0	0	0	1.2	8.6	0	9.8	3.7	22.1	0	25.8
	Sub-total and average	54.9	2.0	328	12.5	45.7	64.3	0	0	0	0	0.9	14.6	0.7	16.2	2.1	32.9	0.7	35.7
	Car Total and average	163.4	1.7	1021	11.0	46.1	74.3	0.1	0.5	0	0.6	2.6	7.8	0.2	10.6	8.9	16.5	0.3	25.7
WFE 66631 Precooled with General American Portable Precooler Unit #P-62																			
B-1	Check	27.0	2.6	156	5.1	47.4	92.9	0	0.6	0	0.6	0.6	1.3	0	1.9	2.6	2.6	1.9	7.1
B-2	Check	27.5	2.9	147	3.4	65.3	97.3	0	0.7	0	0.7	0	2.0	0	2.0	0	2.7	0	2.7
	Sub-total and average	54.5	2.8	303	4.3	56.4	95.0	0	0.7	0	0.7	0.3	1.7	0	2.0	1.3	2.6	1.0	5.0
B-3	Inoc. B. R.	25.0	0	155	8.4	56.8	74.8	0	0.6	0	0.6	6.5	0.6	0	7.1	23.2	2.0	0	25.2
B-4	Inoc. B. R.	26.5	2.3	163	10.4	49.1	73.6	0	0	0	0	2.4	3.7	0.6	6.7	17.2	8.6	0.6	26.4
	Sub-total and average	51.5	1.2	318	9.4	52.8	74.2	0	0.3	0	0.3	4.4	2.2	0.3	6.9	20.1	5.3	0.4	25.8
B-5	Inoc. Rhiz.	25.3	1.6	147	4.1	34.7	59.9	0.7	0	0	0.7	1.4	19.0	1.4	21.8	10.8	27.9	1.4	40.1
B-6	Inoc. Rhiz.	25.0	0.8	166	9.0	47.6	66.9	0	0	0	0	0.6	7.2	0	7.8	2.4	30.7	0	33.1
	Sub-total and average	50.3	1.2	313	6.7	41.5	63.6	0.3	0	0	0.3	1.0	12.8	0.6	14.4	6.4	29.4	0.6	36.4
	Car total and average	156.3	1.7	934	6.9	50.1	77.4	0.1	0.3	0	0.4	1.9	5.6	0.3	7.8	9.4	12.5	0.7	22.6

1/ B - Brown rot; R - Rhizopus rot; O - Other rots

Table 4.--Temperature records during precooling and while enroute from Fort Valley, Georgia to New York City, Test No. 2, 1951

Car C (FGE 39440) - Not precooled												
Position	Reading	Temperature (°F.) at indicated hours after loading										
		0-	0+	3	12	24	36	48	60	72	96	120
Top Bunker	Air	82	63	73	63	41	42	49	40	46	47	50
Bottom Bunker	Air	42	44	44	48	44	44	38	36	38	35	34
TQL	Com.	84	83	81	66	57	49	45	46	43	44	44
MQL	Com.	85	84	78	65	57	51	46	44	43	42	41
BQL	Com.	88	87	74	62	53	48	44	42	40	40	38
Average	Com.	86	85	78	64	56	49	45	44	42	42	41
Car D (WFE 72287) - Precooled with portable compressor												
Top Bunker	Air	84	74	58	50	56	46	56	54	52	52	56
Bottom Bunker	Air	49	51	55	54	40	39	39	39	39	37	37
TQL	Com.	87	85	76	69	60	56	52	52	50	50	48
MQL	Com.	85	83	76	66	58	55	53	50	47	46	43
BQL	Com.	83	81	79	64	53	51	49	45	44	41	41
Average	Com.	85	83	77	66	57	54	51	49	47	46	44
Outside	Air	86	85	77	70	98	72	82	76	67	66	78

- 1/ Positions TQL, MQL, and BQL represent top, middle and bottom quarterlength, respectively.
- 2/ The temperature just before precooling started is represented as the 0-reading and those immediately after precooling started by 0+.

Table 5.--Condition of Early Hiley peaches in test packages on arrival on the terminal market and after 2 and 4 days at room temperature.
(Test 2 - 1951)

Lot No.	Inoculation Treatment	Net Wt. Georgia lbs.	Wt. loss in transit %	Eating ripe at each inspection			Decay at each inspection (Cumulative percent)												
				(Cumulative percent)		Remaining unripe After 4 days %	At arrival		After two days		After four days		Total %	After two days		After four days			
				At arrival 2 days %	After 4 days %		B 1/ %	R 1/ %	Total %	B %	R %	Total %		O %	B %	R %	Total %		
				Total fruit No.			B 1/ %		R 1/ %		Total %			B %		R %			
FGE - 39440 Non-precooled fan car, fans on																			
C-1	Check	25.1	2.8	123	29.3	35.0	3.2	4.1	15.4	0	19.5	5.7	48.8	0	54.5	6.5	55.3	0	61.8
C-2	Check	26.7	0.4	128	28.1	32.0	5.5	0.8	22.7	0	23.4	4.7	53.1	0	57.8	4.7	57.8	0	62.5
	Sub-total	51.8	1.5	251	28.7	33.5	4.3	2.4	19.1	0	21.5	5.2	51.0	0	56.2	5.6	56.6	0	62.2
	and average																		
C-3	Inoc. B.R.	25.2	3.2	129	7.7	9.3	0	3.9	20.2	1.6	25.6	50.4	31.8	1.6	83.7	57.4	31.8	1.6	90.7
C-4	Inoc. B.R.	26.5	0	124	16.1	16.9	0	5.6	8.1	0	13.7	59.7	19.4	0	79.0	62.1	21.0	0	83.1
	Sub-total	51.7	1.5	253	11.9	13.0	0	4.7	14.2	0.8	19.8	54.9	25.7	0.8	81.4	59.6	26.5	0.8	87.0
	and average																		
C-5	Inoc. Rhiz.	25.0	3.2	121	8.3	8.3	0	1.7	51.2	0	52.9	6.6	81.8	0	83.4	7.4	83.5	0.8	91.7
C-6	Inoc. Rhiz.	26.0	2.7	129	17.1	17.8	0	4.7	16.3	0	20.9	14.0	62.0	0	76.0	15.5	66.7	0	82.2
	Sub-total	51.0	2.9	250	12.8	13.2	0	3.2	33.2	0	36.4	10.4	71.6	0	82.0	11.6	74.8	0.4	86.8
	and average																		
	Car total and average	154.5	2.0	754	17.8	19.9	1.5	3.4	22.1	0.3	25.9	23.6	49.3	0.3	73.2	25.7	52.5	0.4	78.6
WFE - 72287 Portable precooled fan car, fans on																			
D-1	Check	25.5	-	136	33.1	49.7	9.1	0	14.0	0	14.0	2.2	30.1	0	32.3	3.7	37.5	0	41.2
D-2	Check	25.6	2.7	128	41.4	62.5	2.3	0	10.2	0.8	10.9	1.6	18.8	2.3	22.7	4.7	30.5	2.3	35.2
	Sub-total	25.6	2.7	264	37.1	56.0	5.7	0	12.1	0.4	12.5	1.9	24.6	1.1	27.7	4.2	34.1	1.1	38.3
	and average																		
D-3	Inoc. B.R.	26.5	2.6	147	10.9	15.0	0	1.4	13.6	0	15.0	57.8	17.0	0	74.8	68.0	17.0	0	85.0
D-4	Inoc. B.R.	24.6	2.8	123	7.3	9.8	0	0.8	28.4	0	29.3	50.4	39.0	0	89.4	51.2	39.0	0	90.2
	Sub-total	51.1	2.7	270	9.3	12.6	0	1.1	20.4	0	21.5	54.4	27.0	0	81.5	60.4	27.0	0	87.4
	and average																		
D-5	Inoc. Rhiz.	24.9	1.6	124	16.9	19.4	0	1.6	12.1	0	13.7	20.2	53.2	0	73.4	20.2	60.5	0	80.6
D-6	Inoc. Rhiz.	23.5	0.9	113	17.8	19.5	0	0	15.3	0	15.3	15.3	59.3	0	74.6	15.3	65.3	0	80.5
	Sub-total	48.4	1.2	242	17.4	19.4	0	0.8	14.0	0	14.5	17.8	56.2	0	74.0	17.8	62.8	0	80.6
	and average																		
	Car total and average	125.1	2.2	776	21.3	29.5	1.9	0.6	15.5	0.1	16.2	25.1	35.3	0.4	60.8	89.7	40.6	0.4	68.6

1/ B - Brown rot; R - Rhizopus rot; O - Other rots.

2/ Percentage weight loss of five test packages.

3/ Percentage weight loss of six test packages.

